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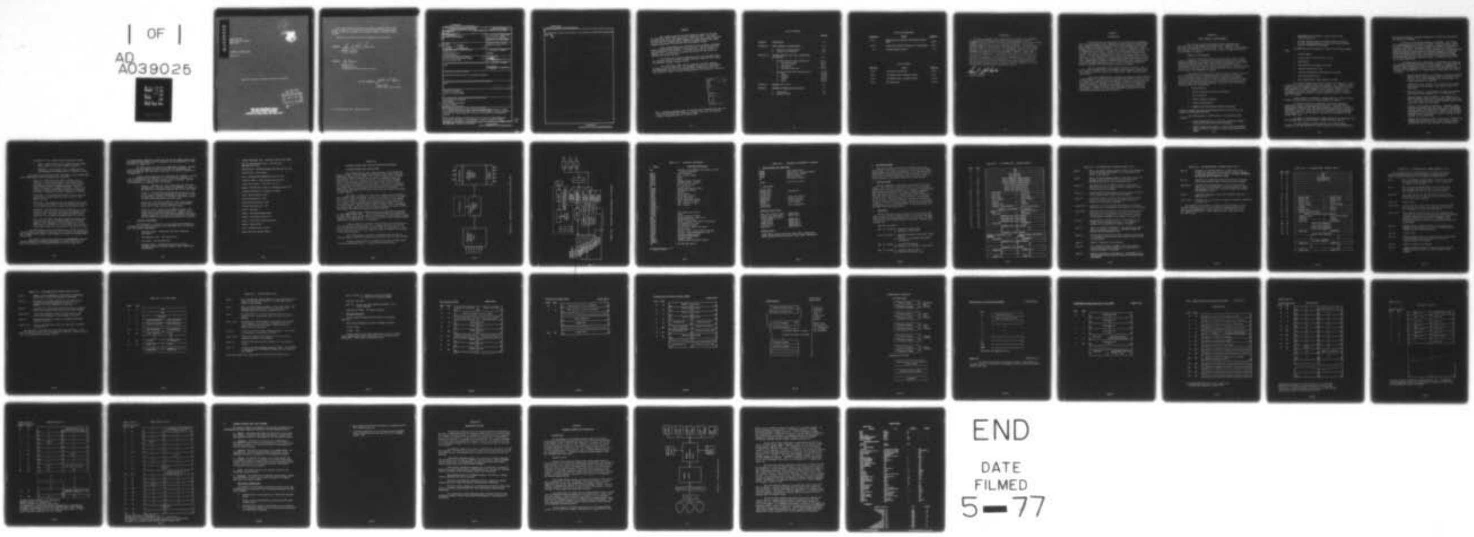

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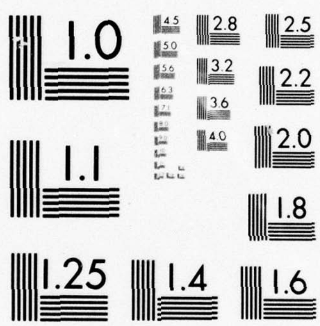

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RADC-TR-77-99
Final Technical Report
March 1977

STANDARD SOFTWARE BASE

INCO, Inc.

Approved for public release; distribution unlimited.

ROME AIR DEVELOPMENT CENTER
AIR FORCE SYSTEMS COMMAND
GRIFFISS AIR FORCE BASE, NEW YORK 13441

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RSX-11D Operating System
Network Routine
Communication Subsystem

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This Technical Report describes research and development conducted by INCO, Inc., during the period 21 April 1975 to 25 August 1976 to provide a Standard Software Base (SSB) supporting operation of the AN/GYQ-21(V) minicomputer system.

Major accomplishments are described in both technical accomplishments and deliverables furnished to the government. The architecture and special features of SSB Release 1, certified by the USAF for release in December 1975, over

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are discussed, as well as the utility of the release for AN/GYQ-21(V) systems and users.

PREFACE

This document provides the Final Technical Report for the Rome Air Development Center under Contract No. F30602-75-C-0174. The report describes research and development conducted by INCO, INC. during the period 21 April 1975 to 25 August 1976 to provide a Standard Software Base (SSB) supporting operation of the AN/GYQ-21(V) minicomputer system.

Major accomplishments are described in both technical accomplishments and deliverables furnished to the government. The architecture and special features of SSB Release 1, certified by the USAF for release in December 1975, are discussed, as well as the utility of the release for AN/GYQ-21(V) systems and users.

The report also describes additional work to be performed under the referenced contract in terms of major technical tasks and their respective schedules through 25 August 1976.*

Mr. Sam DiCarlo, RADC, was the cognizant government engineer during this contract period; Mr. Carl Comptom, Directorate of Intelligence Data Management, Air Force Intelligence Service, Headquarters USAF, was the contracting officer's Technical Representative for contractual activities.

*Due to technical considerations, the contract was accelerated such that the total level of effort was reached on 25 August 1976, vice the original contract termination date of 21 October 1976.

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EVALUATION

The work accomplished under this effort has resulted in a capability for geographically separated intelligence data processing centers to communicate with one another and access "host" computers at these sites through existing communications facilities employing AN/GYQ-21(V) Intelligence Analysis Stations as stand-alone & front-end processors. The Standard Software Base (SSB) is a direct result of technological transfer from the RADC Exploratory Development Program into the operational environment producing an operational capability for the intelligence community. At the same time the work demonstrated the potential of the use of the AN/GYQ-21(V) as a stand-alone, front-end or communications processor that will eliminate duplicative development efforts and allow individual sites to tailor their system to meet site specific requirements. The Standard Software Base will provide users with common system software, basic communications network software capabilities, and a series of software "gateways" for access to external files, data bases, systems and networks.

Samuel S DiCarlo

SAMUEL S. DICARLO
Project Engineer

SECTION I

INTRODUCTION

In 1973 and 1974 the Directorate of Intelligence Data Management, Air Force Intelligence Service, Headquarters United States Air Force (AFIS/IND), conducted a widely ranging survey of USAF Intelligence Data Handling System (IDHS) modernization programs. All of the USAF programs involved implementation of the AN/GYQ-21(V) system as either a stand-alone, front-end, or communications processor. Further, all program development planning featured some form of systems software, many of which were common to one another. To eliminate redundancy in the various development efforts and to realize both cost avoidances and cost savings, AFIS/IND formulated a twenty (20) month program to develop a Standard Software Base (SSB) which will provide: common system software for AN/GYQ-21(V) users, basic communications networking software capabilities, and a series of software gateways for access to external files, data bases, systems, and networks.

Rome Air Development Center (RADC) contracted with INCO, INC. to utilize select capabilities of the Terminal Oriented Support System (TOSS) and to develop specific capabilities meeting major common system software requirements.

This Final Technical Report provides descriptions of major technical accomplishments of the INCO Project Team during the period 21 April 1975 to 25 August 1976 in meeting these requirements. Further, the report describes the architecture and features of two releases of SSB and the "hooks and handles" available in the SSB software which can be used by AN/GYQ-21(V) system users to adapt the SSB to their individual and unique needs and requirements. Finally, the report discusses INCO's projections for SSB development beyond the term of this contract.

SECTION II

MAJOR TECHNICAL ACCOMPLISHMENTS

This section of the Final Technical Report describes major INCO, INC. work accomplishments under Contract No. F30602-75-C-0174. The report is presented in two subsections. First, technical accomplishments are discussed, and then a listing of major technical documents provided to the government is presented.

1. TECHNICAL ACCOMPLISHMENTS

Initially, the baseline Terminal Oriented Support System (TOSS) software, consisting of the Interactive Support Capability (ISC), Terminal Independent Support System (TISS), TOSS Information Management System (TIMS), and the TOSS Exchange Center (TEC) modules were reviewed in terms of capabilities which could directly support USAF AN/GYQ-21(V) systems and users. An additional review was conducted wherein AFIS/IND and RADC personnel defined specific TOSS enhancements required.

Concurrent with these reviews the R&D version of TOSS was installed on the AFIS/IND An/GYQ-21(V) computer system for testing and evalution. Also, a two-node test of the TEC software was conducted using Defense Intelligence Agency (DIA) facilities. Here a single copy of TEC was loaded into each of two Central Processors having DP-11 modem interfaces and connected through crypto and modem equipment. During the test the following features of TEC were demonstrated:

- o Packet Handling
- o Traffic Processing by Mode and Preference
- o Core Monitoring
- o Traffic Integrity Checking
- o Traffic Accountability
- o Logging and Tracing/Network Resource Monitoring.

A special software interface was developed between the TEC and the I/O driver for the BR-1569 controller.

Early enhancements, or modifications, to the baseline TOSS included:

- o An SSB Program Supervisor to provide application program control and control and special interfaces;
- o SSB/User Applications Support to facilitate multi-terminal usage, interfaces to analyst terminals, and extended file support.

- SSB/Communications Support to support node-to-node communications; and

- SSB Data Transfer Support to provide gateway interfaces to other network/systems and perform all required message and data transformation functions.

An AUTODIN gateway was developed to handle the following message types:

- Standard Header

- Standard Header with Automatic Call Back

- Query Header

- Query Header with Automatic Call Back

- Standard Header/Baudot Code

- Standard Header/Baudot Code/Automatic Call Back

- Query Header/Baudot Code

- Query Header/Baudot Code/Automatic Call Back.

The AUTODIN Message Output Generator (AMOG) was modified to include a capability to handle message traffic from magnetic tape. Similarly, the DIAOLS 115 Emulation Package was modified to provide a capability to transfer data transmitted by DIAOLS to magnetic tape as data are received by an AN/GYQ-21(V) and permit retransmittal over the AUTODIN network. Finally, the AUTODIN gateway was modified to permit operation with the new Western Union PTC software.

A NULL gateway was developed to enable intra-site traffic exchange between and among analysts using the same AN/GYQ-21(V) system.

An in-depth analysis was conducted of the Digital Equipment Corporation's Version 6 Operating System (RSX-11D) to determine specific modifications required to the TOSS baseline package, especially in terms of enhancements to the Intertask Coordination Module (ICM) for Operating System Interaction functions. Twenty-one (21) sets of RSX-11D Version 6 Manuals were obtained from DEC and delivered to the USAF for distribution to USAF-managed IDHS sites.

In August, a three-node test of TEC performance was conducted using DIA Arlington Hall facilities linked to ADCOM at Colorado Springs.

All TISS software, suitably modified, was installed during September on the AFIS AN/GYQ-21(V) system together with the AUTODIN gateway.

Testing and evaluation, including integration of the ISC and ICM modules, was completed in November.

Release 1 of the SSB was assembled in December. This release was laboratory tested in the facility located at INCO, thoroughly tested in the AFIS AN/GYQ-21(V) facility, certified by AFIS/IND, and readied for delivery to the field. The release package consisted of a system tape comprising both source and object code for each module and a system (release) generation package; User and Computer Operational Manuals; and Program/System-Subsystem Specifications. In December 1975 AFIS/IND personnel, assisted by INCO personnel, delivered and installed Release 1 at USAFE. An AFIS/IND-INCO team also installed Release I at ADCOM in January 1976, and at SAC in March 1976.

Following completion of SSB Release I, development work began on the remaining technical requirements of this contract: to enhance existing terminal support capabilities, and to develop additional communication network interface gateways. Based on lessons learned during SSB Release I development and implementation, terminal support capabilities were enhanced as follows:

- Expanded Message Handling - All functions involved in message handling (PRINT, SEND, RELEASE, DELETE, and REVIEW) permit users to act on multiple messages, or entire queues, via a single execution of a function.

- Improved Clear Text Displays - All displays decode message classification and precedence from internal format into clear text.

- Extended Input Line - The maximum line length for messages built under SSB was expanded from 72 to 80 characters.

- Expanded Message "BUILD" Capability - For messages to be built from data on magnetic tape, "BUILD" permits selection of the tape drive to be used, thereby avoiding conflict with concurrent journal tape operations.

- Expanded Journal Retrieval Capability - "REVIEWJ" permits retrieval of messages from the journal tape by SSB message sequence number, Date/Time Group, Originator, and Network. Additionally, users can choose to review or print retrieved messages without automatically creating a new copy of the messages on the output queue.

- Enhanced System Console Control - Execution of "TISJOR" and "TISUTL" was restricted to the system console to prevent inappropriate use of these functions by terminal users.

- The addition of new terminal support functions include:

  - "HELP" - Which provides brief explanations and sample input formats for all other terminal functions.

  - "TRANSFER" - Which allows a user to advise users at other terminals of message traffic of interest to them.

Concurrently with terminal support enhancement, the following additional communication interface gateways were developed:

- JANAP 128 - JANAP 128 is the enhanced AUTODIN that is detailed in the DoD AUTODIN manual. The single greatest advantage in the SSB environment is that this allows for point-to-point routing of AUTODIN messages. This will permit the routing of a message not to just a site, but to a specific terminal, application program, host computing facility, or redirected to another communication facility.

- COINS/COINER - The COINS/COINER gateway provides the interface to the DIA COINS switch and also to the U.S. Army ASSIST software.

- DIAOLS-TSS - This gateway allows the terminals connected to the SSB software to appear as if they are directly connected to the DIAOLS system in an interactive time-sharing mode.

- DIAOLS-RJE - The DIAOLS-RJE gateway allows users on the SSB system to submit Batch jobs and receive Batch output from the DIA GE 635. In essence this makes the AN/GYQ-21(V) appear as a GE 115 remote processing station to the DN 30.

- RJE to IBM 360 (2780) - The gateway makes the AN/GYQ-21(V) function as an IBM 2780 terminal connected to an IBM 360 wherein a user connected to the SSB system can, in batch mode, submit a card deck (or file of cards) to be executed on the IBM Host and can in turn receive the resulting output.

The above gateways allow a user connected to the SSB software to run Batch jobs on the IBM 360 or DIA's GE 635; to interact via time-sharing with a DIAOLS GE 635; and/or to send messages or queries via AUTODIN JANAP 128 or COINS.

The terminal support enhancements and the AUTODIN/JANAP 128 gateway were combined with existing SSB software to produce SSB Release II, which was installed on the AFIS/IND AN/GYQ-21(V) in late June, 1976.

The COINS/COINER, DIAOLS/TSS, DIAOLS/RJE, and IBM 360 (2780) gateways were developed and thoroughly tested via simulation on the AN/GYQ-21(V) at INCO by the end of August 1976.

The 2780 gateway was forwarded to USAFE/ACDI in August. However, due to an extended computer failure at AFIS/IND, the COINS/COINER and DIAOLS gateway were not installed at AFIS when this contract terminated on 25 August 1976.

Finally, SSB documentation was reorganized and extended to provide a set of information about SSB that is, at the same time, complete and easily expandable as other software becomes a part of the SSB. This set of documentation is organized into four volumes:

- o Volume I - SSB Overview: This volume contains user-level descriptions of SSB organization and components, as well as AFIS/IND policy statements regarding SSB use and development.
- o Volume II - System/Subsystem/Program Specifications: This volume contains complete information on the design features and operating constraints of individual SSB modules as well as their interrelationships with each other.
- o *Volume III - Test Analysis Report: This volume contains* both a description of and the results of all acceptance tests used to prove existing SSB capabilities.
- o Volume IV - User, Opeator and Programmer Manuals. This volume consists of those manuals that: expalain how to exercise SSB capabilities; describe the computer operator support required for successful SSB operations; and provide the data needed to write SSB-related applications programs.

2. TECHNICAL DELIVERABLES

The following is a listing of a major technical documentation developed and delivered during April 1975 to September 1976 in compliance with contractural requirements:

- o Technical Manual - Installation and Use of TIMS and ISC Modules
- o Test Milestone Plan - TEC Two-Node Test
- o Test Report - TEC Two-Node Test
- o Technical Paper - Comparative Analysis of ISC and Terminal Transparent Display Language (TTDL) Capabilities and Features.

- Program Management Plan - Standard Software Base (SSB)
- Test and Implementation Plan - SSB Test and Implementation Plan
- Specification - BR-1569 Firmware Specification for TEC
- Specification - NULL Gateway
- Plan - Implementation/Management Plan for SSB
- Technical Report - TISS Program Specifications
- Module Descriptions - TISS, TEC, and ISC
- Manual - DEC RSX-11D, Version 6, Operating System (21)
- Program Specification - Redesign for AMOG
- Plan - SSB Distribution Plan
- System Specification - SSB
- Subsystem Specification - SSB
- Program Specifications - SSB
- Manual - SSB Users
- Manual - SSB Program Maintenance
- Manual - SSB Computer Operation
- Report - SSB Interim Technical Report
- Manual - SSB Overview
- Plan - Training Course Outline
- Manual SSB Test Analysis Report.

SECTION III

STANDARD SOFTWARE BASE (SSB) ARCHITECTURE AND FEATURES

1. STANDARD SOFTWARE BASE ARCHITECTURE

The Standard Software Base (SSB) consists of two modular components of TOSS -- The Intertask Control Module (ICM) and the Terminal Independent Support System (TISS). The first of these, ICM, is the SSB sub-executive which co-exists with the RSX-11D operating system; the second, TISS, is a set of systems software and applications programs which provides network capabilities for intelligence analysts using on-line terminals connected to a minicomputer. Figure III-1 illustrates the relationship that ICM and TISS have within the overall TOSS concept. Table III-1 lists the individual SSB modules and their functional descriptions, and Figure III-2 presents the functional interrelationships of these modules.

The design of SSB is such that only a small subset of modules -- ICM, TISIBM, TISMDM, and BFRTSK -- need be core resident, while all others are stored on disk and summoned into core by the anlyst at his terminal or by another module. Moreover, application modules handle only one or two functions, thus permitting small programs to move into and out of core quite rapidly. Service modules (such as TISPRT, TISHVM, and TSMERR) are queue driven, remaining in core so long as requests are queued to them, and exiting core when all requests have been satisfied.

All message data in the SSB system are maintained on disk files in TISS Common Format (TCF). This is the form in which TISS constructs message traffic input by the analyst at his terminal for distribution within domestic or foreign networks. It is also the form to which incoming traffic, addressed to an analyst site, is translated.

Outgoing traffic is initially constructed in TCF and remains in that form through journalization, with a network-dependent copy of the TCF message being constructed by a gateway module and transmitted. Incoming traffic is put in TCF by a gateway module and remains in this form through journalization.

Each TCF message is recorded as a single disk file under a Message Sequence Number (MSN) allocated by the disk I/O processor (MSNTOS).

Message traffic in TCF is recorded in two kinds of fixed length 256 bytes (128 words) blocks: header blocks and data blocks.

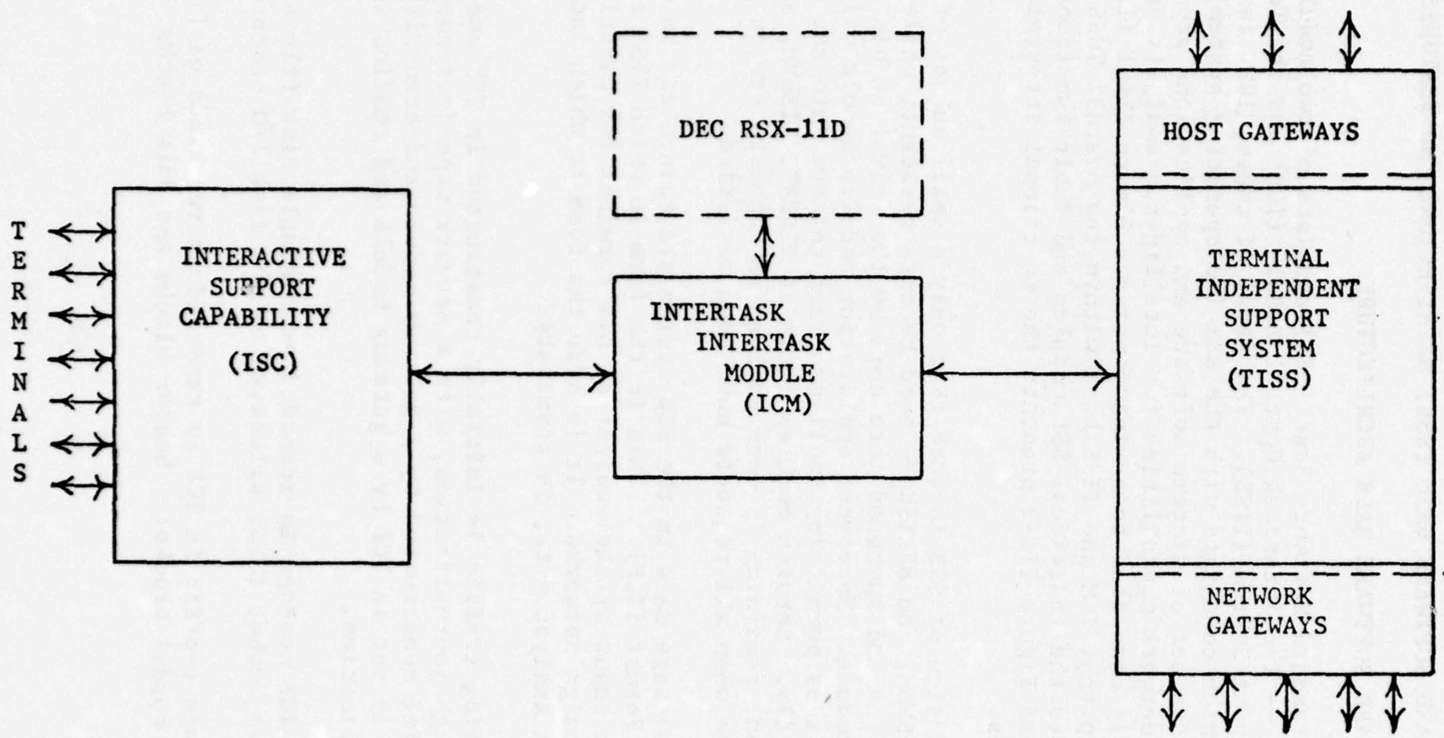


Figure III-1. Relationship of ICM and TISS Modules Within TOSS

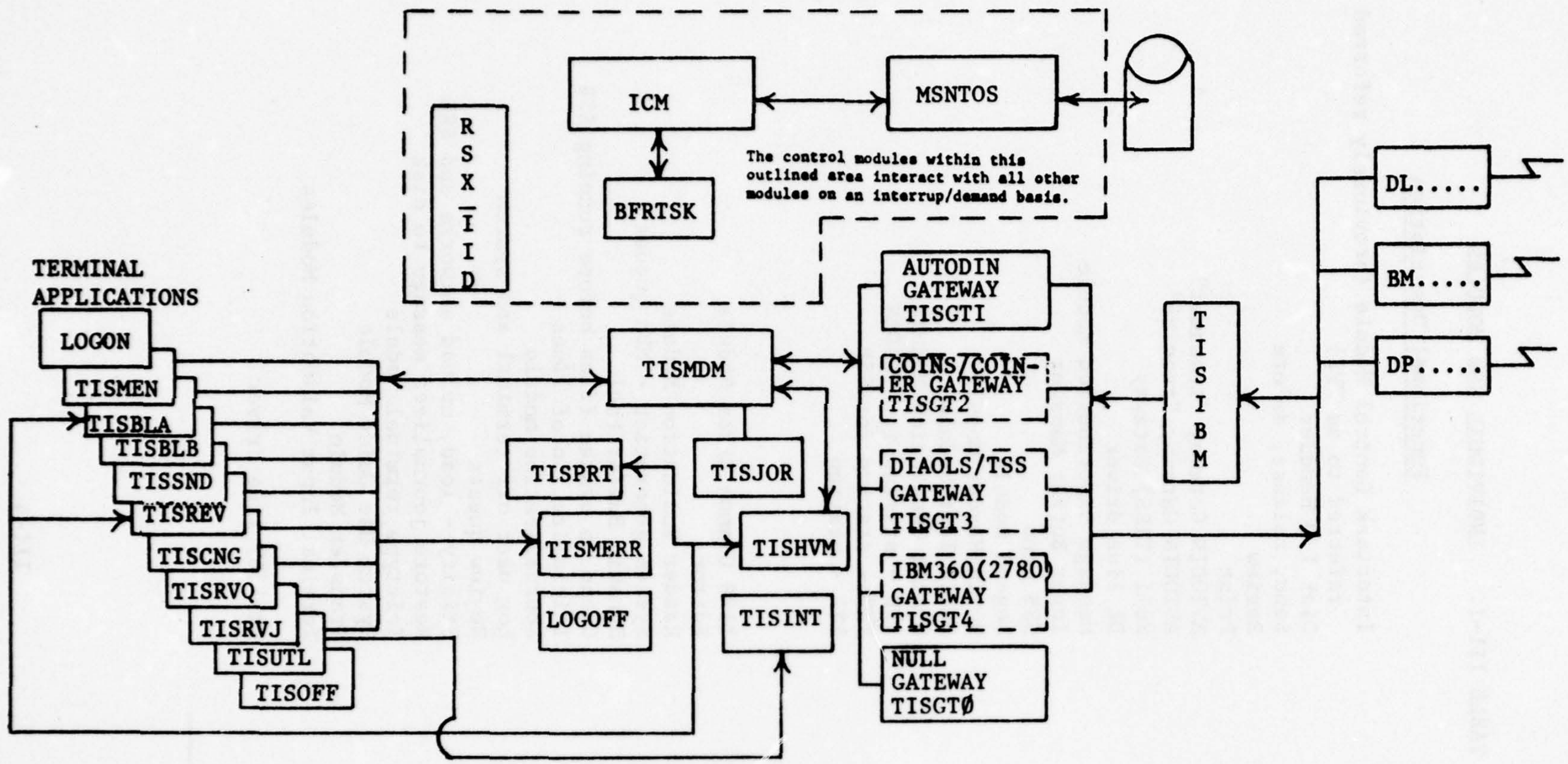


Figure III-2. Functional Interrelationships of TISS Modules

TABLE III-1. INDIVIDUAL SSB MODULES

1. Tasks	Functional Description
ICM	Intertask Control Module (previously referred referred to as TPS)
MSNTOS	Disk I/O Handler
TISSND	Send, release, delete
TISREV	Review
TISPRT	Print
TISGT1	AUTODIN Gateway "transmit"
TISGTA	AUTODIN Gateway "receive"
TISGTØ	Null (TISS) Gateway
DL	DL line driver
TISMDM	Message Distribution Module
TISIBM	Input Buffer Manager
TISMEN	SSB menu
LOGON	Log-on module
TISBLA	Build Header Module
TISBLB	Build Text Module
TISGEN	System Generation Module
TTYNGN	TTØ - startup for TISGEN
TTYNØØ	TTØ - startup for SSB
TTYNØ1 *	TT1 - startup
TTYNØ2 *	
TTYNØ3 *	
TTYNØ4 *	
TSMERR	TISS Common Error Module
TISCNG	Editor
TISHVM	Header Validation Module
QMDM	System generation - MDM queues
BFRTSK	Dynamic Buffer Pool
LOGOFF	Clean up system files before running SSB
TISINT	Initialization of lines
TISJOR	Journalization module
TISOFF	Log user off terminal and system
TISRVQ	Review queues
TISUTL	Utility - load, unload networks and SSB
TISRVJ	Restore journalized message to disk
TDMTTX	Teletype terminal module
HELP	System Use Guide Module
TISXFR	Transfer Module
TISUBA	Terminal Input Validation Modules
TISUBB	Terminal Input Validation Modules
BM	BR 1569 line driver

* Optional Modules

TABLE III-1. INDIVIDUAL SSB MODULES (continued)

2. Object Modules for Task Build

TPSGBL	Global Subroutine
AIPTWX	Application - interface module
TSSCRT	Pseudo screen module
FILESY	ISC file system
AST	AST/STAT$$ Processor
JULIAN	Julian date routine

3. Batch Files

SYSLOD1.BIS SYSLOD2.BIS SYSLOD3.BIS SYSLOD4.BIS	Installation
QUIKGEN.BIS	System File Reload
QGENBLD.BIS	System File Save
SSBGEN.BIS	System Generation
SSB.BIS	Initialization
TISITE.BIS TISQZE.BIS	Site Configuration

Permanent System Files

TOSS User Directory (TUD)	MSNTOS.MSG;1
Gateway File Table (GFT)	MSNTOS.MSG;2
Network Header Validation Table (NHVT)	MSNTOS.MSG;3
TISMDM Queues	MSNTOS.MSG;4
TISMDM Queues	MSNTOS.MSG;5
Directory File	MSNTOS.MSG;62
Dummy File	MSNTOS.MSG;144

Variable Files

TISGTØ (NULL) Network Descriptor Table (NDT)	MSNTOS.MSG;6
TISGT1 (AUTODIN) Network Descriptor Table (NDT)	MSNTOS.MSG;7

a. TCF Header Blocks

Each message recorded in TCF has a header block as its initial block. The first four (words 0-3) words of each header block contain block control information. Header blocks contain routing and control information as required by TISS, (refer to Tables III-2 and III-3 for an explanation of header blocks). Unused portions of the header block will be blank filled.

b. TCF Data Blocks

The data portion of each message is recorded in TCF data blocks. The first three (words 0-2) words of each data block contain block control information. The remainder contain message data, recorded one character per byte. Messages are broken down into lines (records) with a maximum of eighty (80) data characters per record. Trailing spaces in a record are deleted. Each record is terminated by an end of record character (TI.EOR). The last record in a message is followed by an end of message character (TI.EOM). Records may cross blocks, skipping, of course, the block control information in words 0-2. Unused portions of the last data block of a data sequence will be blank filled (see Table III-4).

c. Flag Words

The TCF Flag Words, two per header block and one per data block, contain control information which is used in processing both the block and the message of which it is a part. The uses of these words are largely undefined at present. Current definitions are:

Flag Word One (FW1)

Bit 15	T1.HDR	= 1	Indicates a header block
		= Ø	Indicates a data block
Bit 14	T1.PRT	= 1	Indicates automatic print after transmission
		= Ø	Indicates no automatic print after transmission
Bit 13	T1.NDF	= 1	Indicates NDF message
		= Ø	Indicates TCF message or special file
Bit 12	T1.SPC	= 1	Indicates special file
		= Ø	Indicates non special file

TABLE III-2. TCF HEADER BLOCK, OUTGOING TRAFFIC

WORD	BYTE		
Ø	Ø	MSN	
1	2	BSN	
2	4	FLAG WORD ONE	
3	6	FLAG WORD TWO	
4	8	ORIGIN TERMINAL IDENTIFICATION	
5	1Ø	ORIGIN TERMINAL IDENTIFICATION	
6	12	ORIGIN TERMINAL IDENTIFICATION	
7	14	ORIGIN USER IDENTIFICATION	
8	16	ORIGIN USER IDENTIFICATION	
9	18	ORIGIN USER IDENTIFICATION	
1Ø	2Ø	BUILD YEAR	BUILD YEAR
11	22	BUILD DAY	BUILD DAY
12	24	BUILD HOUR	BUILD HOUR
13	26	BUILD SECOND	BUILD MINUTE
14	28	MINUTES	HOURS
15	3Ø	MESSAGE TYPE	SECONDS
16	32	SECURITY CLASSIFICATION	NUMBER OF DESTINATION NETWORKS
17	34	NUMBER OF CHARACTERS IN THE MESSAGE	
18	36	NUMBER OF ADDRESSES ON THIS NETWORK	FIRST NETWORK DESTINATION NUMBER
19	38	FLAG BYTE	PRECEDENCE
2Ø	4Ø	ADDRESSEE ONE, FIRST NETWORK	
21	42	ADDRESSEE ONE, FIRST NETWORK	
22	44	ADDRESSEE ONE, FIRST NETWORK	
23	46	FLAG BYTE	PRECEDENCE
24	48	ADDRESSEE TWO, FIRST NETWORK	
		ADDRESSEE N, FIRST NETWORK	
		NUMBER OF ADDRESSES ON THIS NETWORK	SECOND NETWORK DESTINATION NUMBER
		FLAG BYTE	PRECEDENCE
		ADDRESSEE ONE, SECOND NETWORK	
		ADDRESSEE N, Nth NETWORK	
		BLANK FILL	BLANK FILL
		BLANK FILL	BLANK FILL

TABLE III-2. TCF HEADER BLOCK, OUTGOING TRAFFIC (con't.)

Word 0	MSN is the Message Sequence Number by which this message is routed through the TISS system. It is the same for all blocks of this message.
Word 1	BSN is the Block Sequence Number of this block within this message, starting with zero for the first block and incrementing by one for each subsequent block.
Words 2-3	Flag Words One and Two (FW1 and FW2) are status words whose bits are set to indicate various operational states of this block and/or message.
Words 4-6	Origin Terminal Identification is the local identification of the terminal which originated this message.
Words 7-9	Origin User Identification is the local identification of the user (analyst) who, using the terminal defined in words 4-6, constructed the message.
Bytes 20-27	Build Year, Day, Hour, Minute and Second are the Julian date and time of construction of the header for this message.
Bytes 28-30	Hours, Minutes and Seconds are the time increment, from the Build date and time, indicating the lag between message construction and transmission. Their values are entered in the header by TISLPM, as the message is transmitted.
Byte 31	Message Type is an ASCII character in the range of zero through 9 which indicates the type of this message in relation to the destination network or networks.
Byte 32	Number of Destination Networks is the number of networks to which this message is addressed. MULTIPLE NETWORKS PER MESSAGE ARE NOT SUPPORTED BY SSB.
Byte 33	Security Classification is an ASCII character in the range of 0 through 9 which indicates the security classification of this message.
Word 17	Number of characters in the message.
Byte 36	First Network Destination Number is the SSB internal routing indicator which specifies the first network to which this message is addressed.
Byte 37	Number of Addresses on this network. SSB SUPPORTS UP TO TEN ADDRESSES PER THE PERMITTED SINGLE DESTINATION NETWORK PER MESSAGE.

TABLE III-2. TCF HEADER BLOCK, OUTGOING TRAFFIC (con't.)

Byte 38	Precedence is an ASCII character in the range of zero through nine which indicates the priority of this message to the first addressee of this network. MULTIPLE PRECEDENCES PER MESSAGE ARE NOT SUPPORTED IN SSB.
Byte 39	Flag Byte is a status byte whose bits are set to indicate various operational states of this block and/or message.
Words 20-22	Addressee One, First Network is the up to six character name of the first addressee of the first network to which this message is addressed. MULTIPLE NETWORKS PER MESSAGE ARE SUPPORTED IN SSB.
Word 23	Flag Byte, Precedence, repeat for subsequent addressee, of Bytes 36 and 37.
Words 24-26	Addressee Two, First Network, repeat for subsequent addressee, of Words 19-21.

The remainder of the header is filled with like information, with a one-word entry like word 17 for each additional network, when multiple networks are supported, and a four word entry, like words 18-21, for each subsequent addressee. Unused trailing bytes of the header block are blank filled.

TABLE III-3. TCF HEADER BLOCK, INCOMING TRAFFIC

WORD	BYTE		
Ø	Ø	MSN	
1	2	BSN	
2	4	FLAG WORD ONE	
3	6	FLAG WORD TWO	
4	8		
5	1Ø		
6	12		
7	14		
8	16		
9	18		
1Ø	2Ø	RECEIVE YEAR	RECEIVE YEAR
11	22	RECEIVE DAY	RECEIVE DAY
12	24	RECEIVE HOUR	RECEIVE DAY
13	26	RECEIVE SECOND	RECEIVE SECOND
14	28	MINUTES	HOURS
15	3Ø	MESSAGE TYPE	SECONDS
16	32	SECURITY CLASSIFICATION	
17	34	NUMBER OF CHARACTERS IN THE MESSAGE	
18	36	NUMBER OF LOCAL ADDRESSES	ORIGINATING NETWORK NUMBER
19	38	FLAG BYTE	PRECEDENCE
2Ø	4Ø	FIRST LOCAL ADDRESSEE	
21	42	FIRST LOCAL ADDRESSEE	
22	44	FIRST LOCAL ADDRESSEE	
23	46	FLAG BYTE	PRECEDENCE
24	48	SECOND LOCAL ADDRESSEE	
		↕	↕
		Nth LOCAL ADDRESSEE	
		BLANK FILL	BLANK FILL
		↕	↕
		BLANK FILL	BLANK FILL

TABLE III-3. TCF HEADER BLOCK, INCOMING TRAFFIC (con't.)

The TCF header block for incoming traffic is similar to that for outgoing traffic except that certain fields are unused while others contain information reflective of the message's incoming state.

Word 0	MSN is the Message Sequence Number by which this message is routed through the TISS system. It is the same for all blocks of this message.
Word 1	BSN is the Block Sequence Number of this block within this message, starting with zero for the first block and incrementing by one for each subsequent block.
Words 2-3	Flag Words One and Two (FW1 and FW2) are status words whose bits are set to indicate various operational states of this block and/or message.
Words 4-9	Unused in SSB.
Bytes 20-27	Receive Year, Day, Hour, Minute and Second are the Julian date and the time at which this message, upon reception was translated into TCF by a gateway module.
Bytes 28-30	Hours, Minutes and Seconds are the tiem increment, from the Receive date and time indicating the lag between message reception and delivery to the local addresses. There values are entered into the header by TISMDM when the authorized recipient executes a review message function for this message.
Byte 31	Message Type is an ASCII character in the range of zero through nine which indicates the type of this message in relation to the originating network.
Byte 32	Unused in SSB.
Byte 33	Security Classification is an ASCII character in the range of zero through nine which indicates the security classification of this message.
Word 17	Number of characters in message.
Byte 36	Originating Network Number is the SSB internal routing indicator which specifies the origin network of this message.

TABLE III-3. TCF HEADER BLOCK, INCOMING TRAFFIC (con't.)

Byte 37	Number of Local Addressees is the number of addressees in this site to which this message is addressed.
Byte 38	Precedence is an ASCII character in the range of zero through nine which indicates the priority of this message to the first addressee of this site.
Byte 39	Flag Byte is a status byte whose bits are set to indicate various operational states of this block and/or message.
Words 20-22	First Local Addressee is the up to six character name of the first addressee of this message in this site.
Word 23	Flag Byte, Precedence, repeat for subsequent addressee, of bytes 36 and 37.
Words 24-26	Second Local Addressee, repeat for subsequent addressee, of words 19-21.

The remainder of the header is filled with like information, with a four work entry words 18-21 for each subsequent addressee. Unused trailing bytes of the header block are blank filled.

TABLE III-4. TCF DATA BLOCK

WORD	BYTE		
0	0	MSN	
1	2	BSN	
2	4	FLAG WORD	
3	6	SECOND CHARACTER	FIRST CHARACTER
4	8	FOURTH CHARACTER	THIRD CHARACTER
38	76	80th CHARACTER	79th CHARACTER
39	78	FIRST CHARACTER	TI.EOR
		↕	↕
41	82	TI.EOR	Nth CHARACTER
42	84	BLANK FILL	TI.EOM
		↕	↕
		BLANK FILL	BLANK FILL

TABLE III-4. TCF DATA BLOCK (con't.)

Word 0	MSN is the Message Sequence Number by which this message is routed through the TISS system. It is the same for all blocks of this message.
Word 1	BSN is the Block Sequence Number of this block within this message, starting with zero for the first block and incrementing by one for each subsequent block.
Word 2	Flag Word (FW1) is a status word whose bits are set to indicate various operational states of this block and/or message.
Words 4-38	Characters are data characters of the first line (record) of the message. Each record of a message may be up to eighty data characters in length. Trailing spaces in each record are eliminated.
Byte 78	TI.EOR is the end of record character (015_8). Each record of a message is terminated by a TI.EOR.
Bytes 79-82	Characters represent data characters of the second and subsequent records of the message.
Byte 83	TI.EOR is the end-of-record character for the preceding record.
Byte 84	TI.EOM is the end-of-message character (03_8). Each message is terminated by a TI.EOM which follows the last record of the message.

Byte 85-on Blank Fill, unused bytes of data blocks are blank filled.

Bit 11 T1.RCV = 1 Indicates receive TCF message
= Ø Indicates non receive message

Bits 10-6 Not used

Bits 5-0 UID of user who originated message or is to receive message.

Flag Word Two (FW2) Not used at present.

d. Sentinel Characters

Two TCF sentinel characters have been so far defined. These are:

End of Record Character and End of Message Character -

TI.EOR = 015_8

TI.EOM = 03_8

Another feature of the SSB architecture is a set of system files, designed with common information, to be accessed by all SSB modules. These files are described below:

User Directory (TUD) **MSNTOS.MSG;1**

Word	Byte	15 8	7 Ø
Ø	Ø	Number of Terminals	Number of Users
1	2	OFFSET TO FIRST TERMINAL ENTRY (15–Ø)	
2	4	Maximum Security Class of First User ID	Abbreviated TOSS User ID, First User
3	6	FIRST USER ID (15–Ø)	
4	8	FIRST USER ID (15–Ø)	
5	1Ø	FIRST USER ID (15–Ø)	
6	12	Maximum Security Class of Second User ID	Abbreviated TOSS User ID, Second User
7	14	SECOND USER ID (15–Ø)	
8	16	SECOND USER ID (15–Ø)	
9	18	SECOND USER ID (15–Ø)	

Gateway File Table (GFT)

MSNTOS.MSG;2

Word	Byte			
Ø	1	15	MSN, GATEWAY Ø (NULL GATEWAY)	Ø
1	2	15	MSN, GATEWAY 1 (AUTODIN GATEWAY)	Ø
		15	MSN, GATEWAY N	Ø
		15	BLANK FILL	Ø
29	58	15	BLANK FILL	Ø

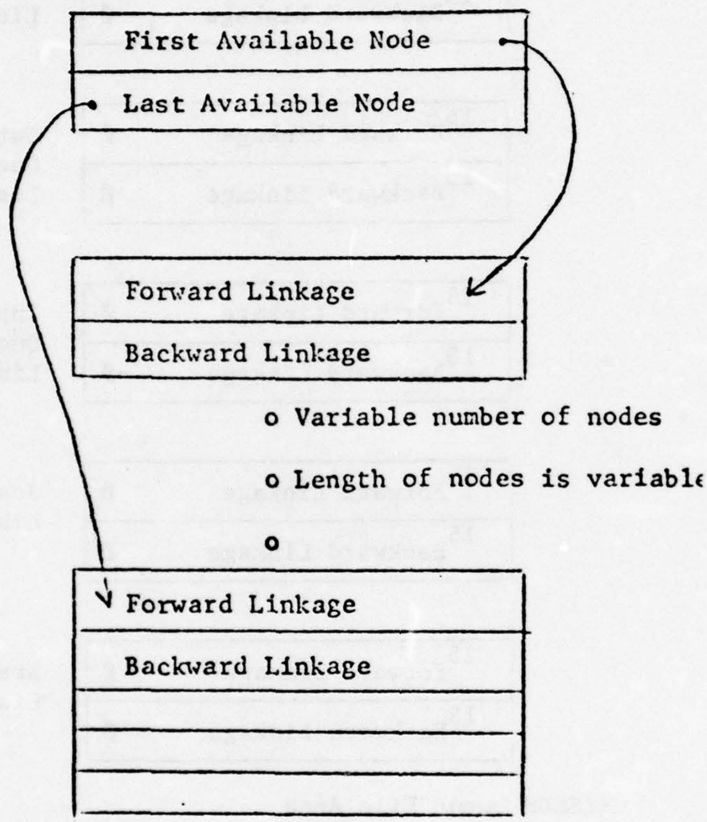
Network Header Validation Table (NHVT)

MSNTOS.MSG;3

Word	Byte	Bits 15–8	Bits 7–Ø
Ø	Ø	Number of Networks	
1	2	First Network Name	
2	4	First Network Name	
3	6	First Network Name	
4	8	Standard RI	Network Number
5	1Ø	Maximum Security Classification	Maximum Precedence
6	12	Non-Standard RI	Maximum Message Type
7	14	Second Network Name	
		...	
		Non-Standard RI	Maximum Message Type

MSNTOS.MSG;4
MSNTOS.MSG;5

TISMDM Queues



Format of available pool for input, output and journal queues.

There is one available pool for messages and one available pool for SRB's.

TISMDM Queues (continued)

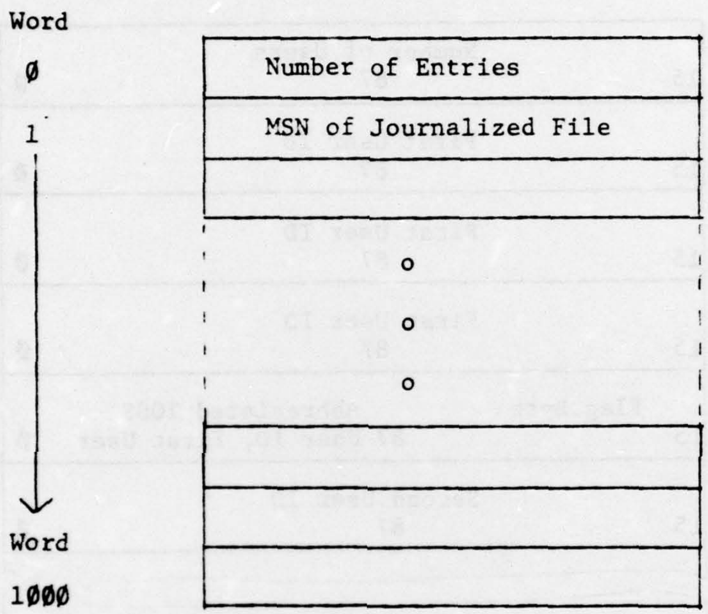
LIST HEAD AREAS

15	Forward Linkage	0	Processing Queue Listhead
15	Backward Linkage	0	
15	Forward Linkage	0	Output Queue Listhead
15	Backward Linkage	0	
15	Forward Linkage	0	Input Queue Listhead
15	Backward Linkage	0	
15	Forward Linkage	0	Journal Listhead
15	Backward Linkage	0	
15	Forward Linkage	0	Status Listhead
15	Backward Linkage	0	

TISMDM Queue File Area

Available Pool for Input/Output Journal Queue
Available Pool for SRB's
Listheads

Directory File of Journalized Messages MSNTOS.MSG;62



*Directory file 1ØØ1 words long

Dummy File MSNTOS.MSG;144

The dummy file consists of 64 words of zeroes. The purpose of the dummy file is to ensure that all messages created by analysts have MSN's greater than 100_{10}.

TISGTØ (NULL) Network Descriptor Table (NDT) MSNTOS.MSG;6

Word	Byte		
Ø	Ø	Number of Users 15 87	Ø
1	2	First User ID 15 87	Ø
2	4	First User ID 15 87	Ø
3	6	First User ID 15 87	Ø
4	8	Flag Byte 15 87	Abbreviated TOSS User ID, First User Ø
5	1Ø	Second User ID 15 87	Ø
		Flag Byte 15 87	Abbreviated TOSS User ID, Nth User Ø

TISGT1 (AUTODIN) Network Descriptor Table (NDT) MSNTOS.MSG;7

First Block:*

Word	Byte	Bit 15	Contents	Bit ∅
∅	∅	15	Byte length of second block of table	∅
1	2	15	Station serial number (Updated by Gateway)	∅
2	4	15	Number of valid security classifications	∅
3	6	15	Offset to security classification field**	∅
4	8	15	Size of TEC for each entry / Size of each security classification entry	∅
5	1∅	15	Number of valid precedences	∅
6	12	15	Offset to precedence field**	∅
7	14	15	Size of each precedence entry	∅
8	16	15	Number of standard internal routing indicators	∅
9	18	15	Offset to internal routing indicators field**	∅
1∅	2∅	15	Offset to UID field within each internal routing indicator entry	∅
11	22	15	Size of each internal routing indicator entry	∅
12	24	15	Number of standard external routing indicators	∅
13	26	15	Offset to external routing indicators field**	∅
14	28	15	Size of each external routing indicator field	∅

* Fifteen words long; each word a binary value
** Offset from beginning of second block

TISGT1 (con't.)

Second Block:

Relative Location Word	Byte	Bits 15–8	Bits 7–Ø
Ø	Ø	T	ASCII Ø (zero) 6Ø
1	2	C	C
2	4	H	T
3	6	S	I
4	8	S	I
5	1Ø	N	A
6	12	X	E
7	14	M	A
8	16	L	P
9	18	blank	E
		T	ASCII 1 (one) 61
		C	C
		15 8	7 Ø

Security Classification = 2Ø.bytes/entry; max entries=1Ø
Arranged Ø-9; Pointer Contained in word 3 of first block
1st character=value Ø-9 ASCII, Following 3 bytes=TCC (ASCII),
Following 16 bytes = ASCII Expansion of TCC

TISGT1 (con't.)

Second Block (con't.)

Relative Location Word	Byte	Bits 15–8	Bits 7–Ø
Ø	Ø	ASCII "O"	ASCII Ø (zero) (6Ø)
1	2	ASCII 1 (61)	ASCII "O"
2	4	ASCII "P"	ASCII "p"
3	6	ASCII "R"	ASCII 2 (62)
4	8	ASCII 3 (63)	ASCII "R"
5	1Ø	ASCII "W"	ASCII "W"
6	12	ASCII "Z"	ASCII 4 (64)
7	14		ASCII "Z"

15 8 7 Ø

Precedence field 3 bytes/entry; Maximum entries = 10. Arranged Ø-9 Pointer Contained in word 6 of first block lst character = ASCII value Ø-9, following two bytes = Precedence.

TISGT1 (con't.)   Second Block (con't.)

Relative Location

Word	Byte		
Ø	Ø	15 Y 8	7 1 character ID for internal RI #1 (ex. ASCII A) Ø
1	2	15 R 8	7 E Ø
2	4	15 D 8	7 A Ø
3	6	15 blank 8	7 A Ø
4	8	15 F 8	7 A Ø
5	1Ø	15 S 8	7 I Ø
6	12	15 I 8	7 blank Ø
7	14	15 D 8	7 N Ø
8	16	15 C 8	7 O Ø
9	18	15 UID 8	7 No. UID's in field Ø
1Ø	2Ø	15 UID 8	7 UID Ø
		↓	↓
24	48	15 Y 8	7 1 character ID for internal RI #2 (ex. ASCII B) Ø
25	5Ø	15 etc. 8	7 etc. Ø

Internal routing indicator = 52. bytes/entry
Maximum entries = 10; Arranged A-J
Pointer contained in word 9 of first block
1st character = 1 character RI-Acronym, followed by 6-7 character RI, followed by 1Ø character name used in "From-To" header line, followed by number of UID's signed on to accept this network's traffic (1 binary byte), followed by each UID (up to 31 allowed).

TISGT1 (con't.) Second Block (con't.)

Relative Location

Word	Byte						
Ø	Ø	15	Y	8	7	1 character ID for external RI #1 (example ASCII A)	Ø
1	2	15	R	8	7	E	Ø
2	4	15	D	8	7	A	Ø
3	6	15	blank	8	7	A	Ø
4	8	15	F	8	7	A	Ø
5	1Ø	15	S	8	7	I	Ø
6	12	15	I	8	7	blank	Ø
7	14	15	D	8	7	N	Ø
8	16	15	C	8	7	O	Ø
9	18	15	flag word	8	7		Ø
1Ø	2Ø	15	Y	8	7	1 character ID for RI #2 (example ASCII B)	Ø
11	22	15	Q	8	7	W	Ø
12	24	15	D	8	7	A	Ø
13	26	15	blank	8	7	O	Ø
14	28	15	D	8	7	I	Ø
15	3Ø	15	S	8	7	H	Ø
16	32	15	C	8	7	/	Ø
17	34	15	N	8	7	O	Ø
18	36	15	D	8	7	A	Ø
19	38	15	flag word	8	7		Ø
2Ø	4Ø	15		8	7		Ø

Routing Indicator = 32 Bytes/entry
Arranged A-J, Pointer Contained in Word 13 of first block
1st character = 1 character RI-Acronym, Followed by 6-7 character RI, followed by 10 character name used in "From-To" header line.

2. STANDARD SOFTWARE BASE (SSB) FEATURES

The current version of SSB (Release II) provides analysts with the following six (6) major functions necessary to process message traffic:

a. Build: The analyst may build (or construct), in a common form, message traffic for any supported network, regardless of the individual protocol requirements of the destination network.

b. Transmit: The analyst can cause, in a common manner, constructed message traffic to be transmitted to its destination network regardless of the individual protocol requirements of the destination network.

c. Receive: The analyst can receive, in a common manner, incoming traffic from any operated network regardless of the individual protocol requirements of the originating network.

d. Review: The analyst can review, in a common manner and form, message traffic in the system, be it locally constructed traffic or that which has been received from a supported foreign network, regardless of any individual protocol requirements of the supported foreign networks.

e. Save: The analyst may save any message traffic in the system for future reference.

f. Retrieve: The analyst may reintroduce saved message traffic into the system in order that it may be reviewed in a manner and form as in current traffic.

SSB Support Capabilities

In addition to the six basic functions described above, the following support capabilities were considered necessary and also were provided:

- Limited access to the system on an individual password basis;

- Access to the system limited to previously authorized terminal only;

- Assurance that security restrictions are not violated by preventing terminal access to analysts not possessing the appropriate clearance;

- Error detection/correction procedures to minimize traffic flow interruptions; and
- A recovery capability so that system use may be resumed after a catastrophic failure with little or no message traffic loss.

SECTION IV

ADAPTABILITY OF SSB

Although the complete set of SSB baseline modules is available to the user, certain modules may be eliminated where there is no need for them. For example, the NULL gateway is valuable for analyst-to-analyst communication within one system. If there is no need for analysts to communicate terminal-to-terminal, the gateway may be eliminated. As gateways are added to the SSB, only those needed at a specific site will be installed and run. If an application program is not of value at a particular site, it too may be eliminated.

A capability exists for a user to construct his own gateway for use with the SSB. All disk I/O is handled through SSB and with additions to ICM and TISMDM tables, these gateways may be used in conjunction with the SSB software.

Application programs specific to a site may be written using the SSB facilities such as disk I/O (MSNTOS), external buffers (ICM and BFRTSK) and the ICM macros. The programs may be run in conjunction with SSB by using the RUN: function of the SSB menu (TISMEN).

Site-written application programs may be called from a gateway to share data as they come in over a communication line. The use of external buffers, inherent in the SSB design, permits this capability.

With modifications to the AUTODIN gateway, the ability to handle multiple AUTODIN lines can be included.

The DL-11, developed for AUTODIN interface, driver is a general purpose module for other asynchronous communications interfaces.

The DP-11 driver, developed for DIAOLS/RJE and IBM 360 (2780) interface, is a general purpose module for other synchronous communications interfaces.

It is possible to screen analysts and/or terminals based on data integrity criteria to allow only authorized personnel to access parts of the system.

SECTION V

STANDARD SOFTWARE BASE PROJECTIONS

1. INTRODUCTION

The development of operational software under this contract terminated with the completion of Release II and its associated gateways, in the summer of 1976. AFIS/IND has established 31 January 1977 as the delivery date for Release III of SSB. Therefore, INCO used the period following completion of Release II through the end of this contract to establish Release III design criteria. The following discussion of those criteria includes major contributions from two RADC-sponsored research and development projects: Terminal Transparent Display Language (TTDL) and Integrated Work Plan (IWP).

2. RELEASE III SSB

Release III of SSB will contain major design enhancements to alleviate many of the limitations experienced with Release I and Release II. While Release I and II have supported AUTODIN, DIAOLS, COINS and IBM 360 remote job entry, the ability to transfer data from one of these networks to another has not been achievable. Release III will provide for this capability by including a general purpose data routing mechanism which permits a flexible multinode data storage structure to allow cross network routing. For the purposes of discussion, this structure is designated the Gateway Manager concept.

The Gateway Manager concept extends to all phases of SSB development for Release III in that the Message Distribution Module is totally responsible for routing, thus eliminating all terminal interactions. Figure V-1 expresses an overview of the Gateway Manager concept. Another extended capability provided for in SSB III will be the ability to interface SSB to other unique (site-dependent) systems.

One should note the design for the Gateway Manager concept centers upon the Message Distribution Module and the restrictions it places upon all other software. These restrictions are placed so as to disallow modules from penetrating the system. Separating the communications software from the terminal software is the Message Distribution module. Likewise, separating the terminal software from site unique system software is the Message Distribution Module.

Another reason for centralizing control in the Gateway Manager concept is to provide for automatic journalization of <u>all</u> traffic in the

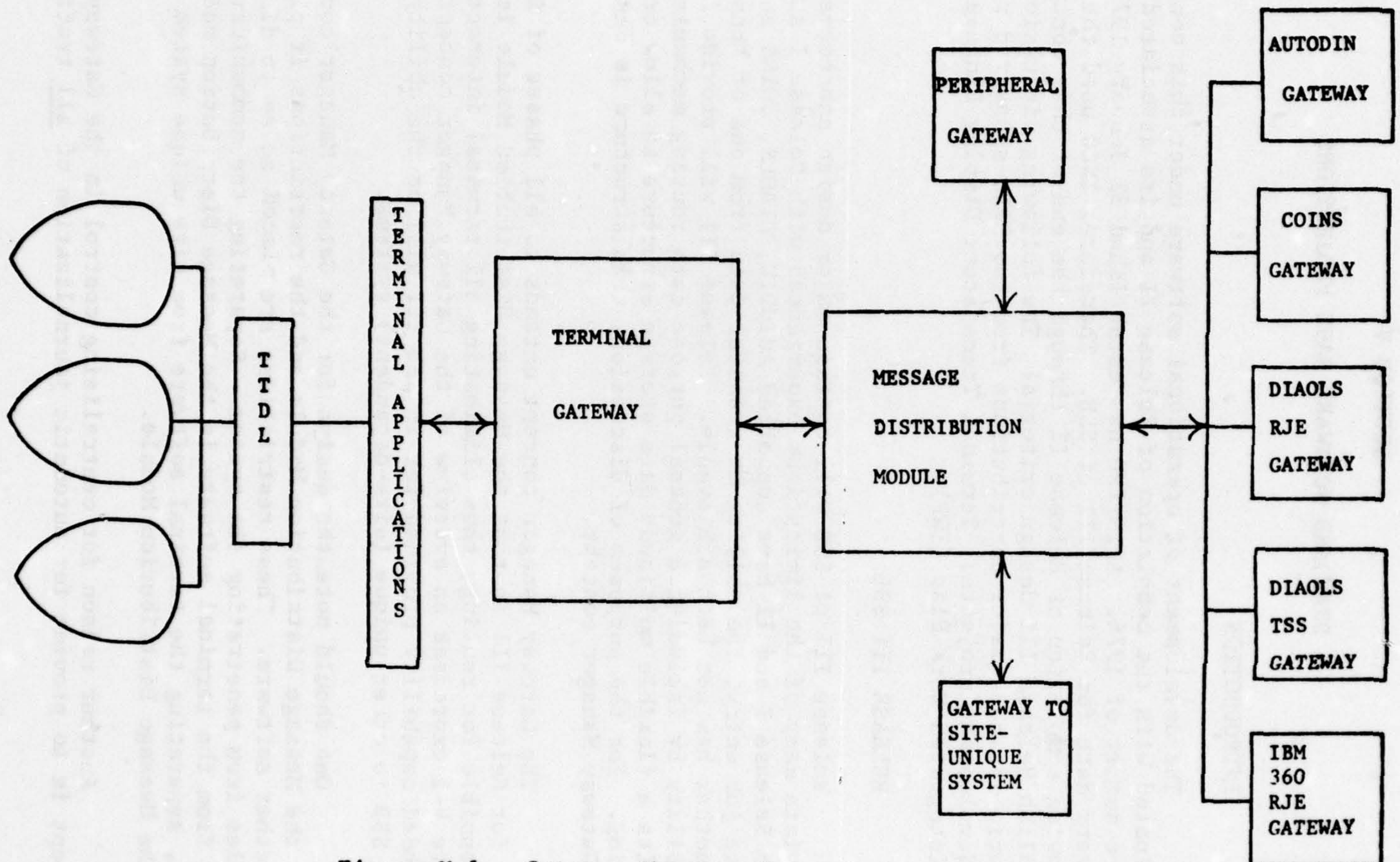


Figure V-1. Gateway Manager Concept

system prior to being processed, for example, by a terminal analyst. On both incoming and outgoing traffic, the Gateway Manager, or Message Distribution Module, routes the traffic to the accountability module for journalization, in addition to routing it to the eventual destination. This will provide the system or site manager with all the historical information necessary to make proper decisions concerning network utilization, through network routing, terminal activity, etc.

Another major design enhancement of SSB Release III will be to replace the Interactive Support Capability (ISC) with the Terminal Transparent Display Language (TTDL). This enhancement will provide support of UNIVAC 1652, IBM 3270, TTY model 40 terminals as well as the current support for TTY-compatible terminals. In addition, the application software will be designed and implemented in such a way that they are multi-user packages, i.e., reentrant. Currently under Release II using ISC, if two analysts require the use of, for example, the BUILD program, two copies of this program are required. The use of reentrant code in SSB III will reduce core requirements and provide for the capability to support more terminals.

The third major design enhancement projected for Release III will be the adoption of the WICS Common Format for all communications traffic. This format was jointly produced by in-house DIA personnel and members of INCO's Integrated Work Plan (IWP) project currently contracted to RADC. This format allows in a more concise method the routing of traffic from one network to another in addition to providing a "logical block or record" concept. This blocking concept allows the inclusion of network dependent information <u>only</u> when required, thus making the header portion a variable length. This format is a definite improvement over the format designed for Releases I and II of SSB.

The other benefits gained by using this new format concern the WICS II network. Because SSB Release III will employ this format, no data conversion or routing algorithms will be required to interface with the WICS network. Thus users of SSB may communicate via the WICS network without providing any additional software, with the exception of the required WICS II software itself.

The fourth major design enhancement projected for Release III will be that of a sharable global library of routines which all SSB modules will use. This enhancement will provide common routines for use by all Gateways, all terminal applications, and many of the supportive software modules. These routines will be designed in Position-Independent Code (PIC) and thus will be reentrant, thereby allowing many programs to share these routines simultaneously in core. Again, as with multi-user applications, this convention will further reduce core requirements.

METRIC SYSTEM

BASE UNITS:

Quantity	Unit	SI Symbol	Formula
length	metre	m	...
mass	kilogram	kg	...
time	second	s	...
electric current	ampere	A	...
thermodynamic temperature	kelvin	K	...
amount of substance	mole	mol	...
luminous intensity	candela	cd	...

SUPPLEMENTARY UNITS:

Quantity	Unit	SI Symbol	Formula
plane angle	radian	rad	...
solid angle	steradian	sr	...

DERIVED UNITS:

Quantity	Unit	SI Symbol	Formula
Acceleration	metre per second squared	...	m/s
activity (of a radioactive source)	disintegration per second	...	(disintegration)/s
angular acceleration	radian per second squared	...	rad/s
angular velocity	radian per second	...	rad/s
area	square metre	...	m
density	kilogram per cubic metre	...	kg/m
electric capacitance	farad	F	A·s/V
electrical conductance	siemens	S	A/V
electric field strength	volt per metre	...	V/m
electric inductance	henry	H	V·s/A
electric potential difference	volt	V	W/A
electric resistance	ohm		V/A
electromotive force	volt	V	W/A
energy	joule	J	N·m
entropy	joule per kelvin	...	J/K
force	newton	N	*kg·m/s*
frequency	hertz	Hz	(cycle)/s
illuminance	lux	lx	lm/m
luminance	candela per square metre	...	cd/m
luminous flux	lumen	lm	cd·sr
magnetic field strength	ampere per metre	...	A/m
magnetic flux	weber	Wb	V·s
magnetic flux density	tesla	T	Wb/m
magnetomotive force	*ampere*	A	...
power	watt	W	J/s
pressure	pascal	Pa	N/m
quantity of electricity	coulomb	C	A·s
quantity of heat	joule	J	N·m
radiant intensity	watt per steradian	...	W/sr
specific heat	joule per kilogram-kelvin	...	J/kg·K
stress	pascal	Pa	N/m
thermal conductivity	watt per metre-kelvin	...	W/m·K
velocity	metre per second	...	m/s
viscosity, dynamic	pascal-second	...	Pa·s
viscosity, kinematic	square metre per second	...	m/s
voltage	volt	V	W/A
volume	cubic metre	...	m
wavenumber	reciprocal metre	...	(wave)/m
work	joule	J	N·m

SI PREFIXES:

Multiplication Factors	Prefix	SI Symbol
1 000 000 000 000 = 10^{12}	tera	T
1 000 000 000 = 10^{9}	giga	G
1 000 000 = 10^{6}	mega	M
1 000 = 10^{3}	kilo	k
100 = 10^{2}	hecto*	h
10 = 10^{1}	deka*	da
0.1 = 10^{-1}	deci*	d
0.01 = 10^{-2}	centi*	c
0.001 = 10^{-3}	milli	m
0.000 001 = 10^{-6}	micro	µ
0.000 000 001 = 10^{-9}	nano	n
0.000 000 000 001 = 10^{-12}	pico	p
0.000 000 000 000 001 = 10^{-15}	femto	f
0.000 000 000 000 000 001 = 10^{-18}	atto	a

* To be avoided where possible.

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